FRAMATOME COGEMA FUELS

Robert B Hoffman
President

January 23, 1997

Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Reference: R. M. Gallo to J. R. Bohart, "NRC Inspection Report No. 99900001/96-01," letter dated November 25, 1996.

Dear Mr. Gallo:

In the referenced report, it was stated that the inspectors observed certain FCF activities that were considered weaknesses that could affect quality. Of those described in the referenced report, the inspectors considered the most significant weaknesses to be (a) the lack of detailed design instructions and (b) the lack of an overall multi-disciplinary review of the Three Mile Island Unit 1 Cycle 10 reload core design process by FCF to identify and evaluate the synergistic effect of design changes.

In order to facilitate NRC closure of this matter, Attachment 1 to this letter provides the steps that have been taken or will be taken by FCF to address these weaknesses. As noted in this Attachment, FCF is taking steps to improve the reload design process. However, FCF believes that the steps followed in the past have been and will continue to be adequate to insure the technical accuracy of the reload design process.

During our review of the referenced report, we noticed several sections of the report that would benefit from some clarification to aid in understanding of the issues involved. These clarifications are included in Attachment 2 to this letter.

Should you have any questions or need more information, please contact me at (804) 832-2822.

Yours Truly,

R B Hoffman

R. B. Hoffman

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FRAMATOME TECHNOLOGIES

Framatome Cogema Fuels
3315 Old Forest Road, P.O. Box 10935, Lynchburg, VA 24506-0935
Telephone: 804-832-2822 Fax: 804-832-2997

xc: Mr. Robert M. Gallo
Chief, Special Inspection Branch
Division of Inspection & Support Program
Office of Nuclear Reactor Regulation
Washington, D.C. 20555-0001

Attachment 1

FCF Responses to Weaknesses Cited in
NRC Inspection Report No. 99900001/96-01

Steps Related to Design Instructions

FCF is in the process of migrating to the Framatome SCIENCE code package for fuel cycle design and core neutronics analyses. There will be considerable automation involved in its use, and precise analysis processes will be defined during the transition to the SCIENCE system. These process definitions will help to provide the basis for the development of analysis guidelines and calculation review checklists. In addition, a process improvement (PI) team was chartered for Reload Analysis and Licensing Services (RALS) activities in July, 1996. This RALS PI team has recommended the development of general analysis guidelines and checklists for each RALS task area, and will be refining the steps necessary to do this during 1997. A more detailed discussion including background on our past and current practice relative to reload design activities is provided in the following paragraphs.

Up to the present, FCF has ensured the technical accuracy and completeness of our reload design activities through the following process:

- Identification, documentation, and approval of specific and general requirements for a reload which vary from plant to plant (customer requirements and plant safety analyses differences are addressed)
- Use of the previous cycle's analysis as a starting point and detailed sample calculation
- Reliance on the experience of the task engineer and supervisor of each technical group, and
- Assignment of an experienced reload team, led by a Reload Licensing Analysis Task Engineer, who facilitates close communication of all issues associated with the plant and its cycle design.

For the future, FCF will be automating the nuclear analysis process. The CASMO/NEMO code system was first used by FCF in 1993 for design and licensing of reload cores. The NEMO code was developed jointly with Framatome and is being incorporated in an integrated code package, SCIENCE, which FCF is adopting for application in the U.S. The CASMO code will be replaced with APOLLO2 which is an advanced assembly lattice code.

SCIENCE has strong calculational automation capability through the COPILOTE system. COPILOTE provides a graphical user interface along with a "frozen" calculational path and

outputs for previously defined calculations. A full range of tasks, from calculation of a single parameter to an entire reload licensing analysis can be predefined, tested, documented, and fixed for every type of reload neutronic analysis.

The FCF program for adoption of the SCIENCE package includes submittal of a bench marking topical report to the NRC for approval in late 1997. Training and development of customer-specific output formats will begin in 1997, followed by implementation for reload licensing analysis in 1998 through 2000.

In addition, as noted above, FCF has chartered a process improvement team to provide a comprehensive review of the reload design process and to define changes that will enhance its quality and efficiency. The team has completed an initial review, and will be working on various improvements during 1997. The team has recommended that general analysis guidelines be developed in each reload task area, including review checklists that would be used in the QA of reload analyses. The team will begin the development of these guidelines/checklists during 1997.

This guideline/checklist development will be integrated with the implementation of the SCIENCE package. In the interim, FCF believes that the steps followed (as listed at the beginning of this discussion) in the past have been and will continue to be adequate to insure the technical accuracy of the reload calculations performed.

Steps Related to Multi-discipline Design Review

The RALS PI team described in the previous response has considered the subject of multi-disciplinary design reviews, and has recommended that future reload design teams consider the need to enlist specialized expertise in evaluating the effects of cycle designs with parameters outside the bounds of past experience. The team will determine the need for specialized expertise as well as the need for a formal design review board.

There have been numerous reviews of the TMI-1 cycle 10 core design and fuel performance. These reviews included multi-disciplinary 24-month cycle feasibility studies performed prior to the cycle 10 design, multi-disciplinary internal reviews at the feasibility stage and during the cycle design, a multi-disciplinary customer design review, a multi-disciplinary Plant Safety Committee review, and pre-planned follow up reviews, including an on-site fuel inspection. These reviews occurred during the cycle 10 core design as well as subsequent to the occurrence of leaking fuel during cycle 10. Activity investigating the TMI-1 cycle 10 occurrence is ongoing and a hot cell examination of fuel from TMI-1 cycle 10 is in the final planning stages.

Background Concerning the Occurrence of a Distinctive Crud Pattern (DCP).

The TMI-1 cycle 10 design was optimized to maximize core lifetime yet remain within all

reload design criteria. One aspect of the optimization is minimal use of burnable poison resulting in minimal residual absorber poisoning.

Power distributions and fuel assembly outlet temperatures for cycle 10 of TMI-1 were consistent with recent designs and are bounded by a similar plant which operates at a slightly higher total power level. The typicality of TMI cycle 10 is further supported by the performance of TMI cycles 8 and 9. Both of these cycles had a "T" type arrangement of the fresh fuel and similar interface power peaking. DCP did not occur in either TMI cycle 8 or 9. In general, conditions for TMI 1 cycle 10 were well within FCF and industry accepted design criteria.

The characteristics of TMI-1 cycle 10 which were not typical were the beginning of cycle boron concentration which was FCF's highest and the large pH swing during the first six months of operation.

FCF has expended great effort to avoid leaking fuel and believes that the guidelines recommended by FCF concerning water chemistry will prevent a recurrence of DCP and any associated clad thinning. Based on the extended operation of the current cycle of TMI-1 with no indications of leaking fuel, the guidelines are successful.

Attachment 2

FCF Clarifications and Suggested Factual Corrections to
NRC Inspection Report No. 99900001/96-01

Page 7

The RELATE responsibilities are the scheduling and integration of reload analysis activities. This individual does not "maintain the technology for the task" since the RELATE task does not involve any technology in the strict sense of the word. The Task Engineer for each specific analysis task has the responsibility for maintaining the technology for that task.

The RALS reload design team (not "inspectors") is made up of the RELATE and representatives from each analysis task. The team members perform the required analyses in a team environment, maintaining the quality of the service and ensuring timely interaction with the licensee. The RALS team members are not "inspectors."

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The RALS team members are not "inspectors", see the comment for page 7.

Page 16

Mild DCP indications occurred on rods in 6 fuel assemblies at Crystal River 3 after Cycle 10.

Page 17

TMI and CR3 Cycle 10 increased boron to approximately 1800 ppm at startup, not 1500 ppm. These plants, and other B&W plants as well, have had BOC boron concentrations at and above 1500 ppm for several cycles.

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The August 28, 1995 letter to GPUN provided coolant chemistry recommendations for TMI-1 Cycle 11, not Cycle 13.

As stated in the B&W Owners Group topical report BAW-10179, "except for special testing that is monitored on a cycle specific basis, lithium levels are currently limited to a nominal value of 2.2 ppm until data supports operation at higher values". In the cycle 10 design, low pH was considered a lesser and acceptable condition as compared to a higher lithium concentration. When it appeared that crud levels may cause blockage of CRDM valves, allowable lithium levels were raised and an inspection program invoked.

FCF has no data indicating a BOC quadrant power tilt of +15% at the sixth axial span, or for any span during Cycle 10. At BOC the level 6 power tilt in the core quadrant (Z-W) where a significant fraction of the DCP occurred was 0.5%. At end of cycle (EOC) the quadrant tilt in that quadrant was approximately +3.0% in level 6. Note that boron "hideout" in the crud would be characterized by a negative value for the tilt, and only after the boron was gone would the effect cause a higher than predicted power. Some individual incore detector locations did indicate higher than predicted powers in level 6 at EOC by up to 13%. This behavior could be attributed to boron "hideout."

Assembly bow and the effect of gaps are included in FCF's ongoing studies.

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The statement that "other FCF core designs have either not used the 'T' loading, or used an 'L' loading which had lower pin peaking" is incorrect. Both Cycles 8 and 9 of TMI-1 used the "T" loading pattern, and the peaking in the interface region in Cycle 8 was within 2% of that for Cycle 10. The "T" pattern was <u>not</u> new for Cycle 10, and experience in the previous two cycles did not indicate any problems with the power predictions in that region as recognized on pages 20 and 21 of the inspection report.

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The date of 1983 stated in the second paragraph should be 1993.

Page 25.

As stated in the inspection report "based on this review, the inspector concluded that NEMO can accurately predict core power distributions within the accuracy stated in the NEMO topical report. The inspectors also concluded that the current and upcoming core designs were within the range of fuel design configurations and core parameters that were verified in the topical report." Because other sections of the report contained critical comments concerning the NEMO code, FCF submitted additional benchmark results to the inspection team to further verify the code system in a letter dated July 3, 1996. The conclusion of this additional work was that the code system "continues to demonstrate a reliable capability for both heterogenous environments and power distribution gradients. CASMO3/NEMO can be applied to multiple burnable poison configurations, core reactivity calculations, local peaking with gradients, and gadolinia assembly control rod calculations with confidence."